CARDEROCK DIVISION, NAVAL SURFACE WARFARE CENTER

TECH transfer UPDATE

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Annual Issue on Patents

Federal Laboratory Consortium Award Winners for Technology Transfer

In 1984, the Federal Laboratory Consortium for Technology Transfer (FLC) established the FLC Awards for Excellence in Technology Transfer to recognize individuals within federal laboratories who have done outstanding work in transferring technology. The nominees are judged by a panel of experts in the field of technology transfer, and includes representatives from industry, state and local government, academia, and the federal laboratory system. This is the most recognized award for technology transfer in the federal laboratories.

The Carderock Division, Naval Surface Warfare Center has won the FLC Award five times in the past six years. Mr. Amarnath Divecha and Mr. Subhash Karmarkar will be honored for their work in Centrifugal Casting of Metal Matrix Composites in May during the annual FLC meeting in Burlington, VT.

Centrifugal Casting of Metal Matrix Compoisites

Mr. Amarnath Divecha and Mr. Subhash Karmarkar have invented a technique to centrifugally cast metal matrix composites. By carefully selecting a metal alloy for the matrix material and a very hard powder for desired wear resistant characteristics, the inventors can create a wide variety of parts including tubes, brakes, clutches and gears that have different desirable material properties in different sections of the part. This proved immensely valuable to the Navy when changes in environmental regulations necessitated replacement of asbestos brake pads with new materials. The life of the bronze friction

From left: Todd G. Johnson, MSE Technology Applications, Inc., Amarnath P. Divecha and Subhash D. Karmarkar the Division's FLC award winners. Several items on the table can be made using the patented centrifugally cast metal matrix composites.

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drum in the Navy standard winch was now reduced to less than 100 hours. The cost of operation soared to $253 per hour. The inventors proposed replacing these drums with centrifugal castings using an advanced aluminum bronze-titanium carbide metal matrix composite. The replacement drums showed no significant wear in over 1,000 hours of operation. This dropped the cost of operations to $18 an hour. The five-year projected savings could amount to 38 million dollars. This first application of centrifugal casting of metal matrix composites has won the 1997 DOD logistics life cycle cost reduction award and the prestigious Navy Cheapskate Award. The inventors have transferred this technology through numerous presentations, a patent and two subsequent patent applications. Seeking a second procurement source for the Navy, the inventors, on their own initiative, located U.S. Bronze Foundry and Machine and entered into a CRADA with this organization.

The inventors also located John Crane Marine U.S.A., a company interested in applying this technology to large diameter seal rings. These castings weigh as little as 143 pounds or as much as 5,642 pounds. A CRADA has been signed and a patent license is now being negotiated with this company. Finally, MSE Technology Applications has licensed this patent for a wide variety of automotive and aerospace applications. MSE has subsequently granted a sublicense to Swan Metal Composites, a new small company, to further develop commercial applications for this technology. The Navy MANTECH program is also promoting this technology.

Licensing Navy Technology

Navy Patents can provide corporations with an extremely valuable opportunity to take technology developed for military applications to the commercial marketplace. The licensing of these patents is one form of transferring the Federal lab developed technology to private business for commercialization. This licensing process has been significantly improved by the recent legislation including the Technology Transfer Commercialization Act of 2000 also known as the Morella bill.

The initial introduction of a prospective licensee to an invention or technology often takes place between the government engineer or scientist and his counterparts in business. This happens at technical conferences and symposia, through the published technical papers, etc. This direct involvement between government technical personnel and their peers in business is the best patent marketing process in our experience. Other marketing alternatives include patent searches and direct contact between the Navy and a corporation sometimes assisted by an intermediary or broker. A patent search may begin by using the Carderock Division internet site of all the Divisions patents: www.dt.navy.mil/techpat. If the search identifies a patent having common interest, a Cooperative Research and Development Agreement (CRADA), may be helpful. A CRADA will establish a partnership allowing government and business to share the cost and benefits associated with the continued development of the technology.

Often initial contact occurs when a company makes an inquiry concerning the availability of a patent for licensing or simply wants to know what the Navy is doing in their field of interest. The Technology Transfer Office can quickly inform the company what patents are available for licensing in their area of interest and can also place the company's technical experts in contact with their peers at the Navy Laboratory.

Completion of the License Application Form (form and instructions can be found at www.dt.navy.mil/techpat) is the first formal step in applying for a license. A key part of this process is the plan for development and/or marketing of the invention that must be provided by all applicants for a Navy license. This plan must contain specific information on the fiscal resources, facilities and equipment, technical and other personnel to be committed to bring the invention to the commercial market place. The plan must identify a schedule with milestones for introduction of the commercial product. In addition, the plan should include projected yearly sales figures for several years of the license.

A request from a company for a partially exclusive or an exclusive license will generate a notice in the Federal Register of intent to grant exclusive license. This starts a 15-day waiting period wherein a protest to the exclusive license may be submitted. If no protests are received, a Determinations and

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Licensing Navy Technology (Continued from page 2)

Findings memo is prepared and signed by the commanding officer. Once the Determinations and Findings memo is complete no other company can enter into negotiation with the government to license that technology in the same field of use until the license has expired or the company abandons the application.

Each negotiation is a unique process based on the perceived value of the technology, the stage of development of the technology, and the scope of the license. Licenses must be fair and reasonable for the Navy and the licensee to insure commercial application of the invention. Most licenses will include an up-front fee, a running royalty and a minimum annual royalty.

The licensing of an invention may include a CRADA with the Navy for the transfer of the detail technology, know how, and/or further development of the invention. The use of a CRADA is an excellent approach for a licensee. CRADAs are the means to establish a contractual partnership for commercial development, and to benefit the Navy. Also, both parties have specific rights to new inventions made while doing work under a CRADA. Detailed information on CRADAs is available from the Carderock Technology Transfer Office and the web site www.dt.navy.mil/techpat .

Ceramic Science and Technology

The Ceramic Science Group at Carderock has a staff of personnel with experience in monolithic and composite ceramics, carbon/carbon composites, high temperature coatings, and joining of high temperature materials. The Group has recently participated in the development of a multifunctional shipboard armor, a multifunctional composite ship exhaust stack, and two environmental related projects on thermal processing of shipboard wastes. Currently, the Group is developing oxidation resistant non-oxide ceramics for ultra high temperature service, which will find applications in the missile, engine, and waste incinerator communities. This research investigating the oxidation behavior of zirconium and hafnium based borides, carbides and nitrides is leading to an understanding of oxidation mechanisms over a wide range of temperatures and pressures. This work will lead to an optimized environmental performance of many Naval and commercial systems. Another current research thrust is the development of low-cost, low-density, multifunctional ceramic composites for shipboard applications.

Group efforts led to several patented materials including mullite (aluminosilicate) whiskers, celsian (barium/strontium aluminosilicate) dielectric materials for radomes, and several variations on celsian with improved mechanical and electrical properties and lower cost processing. Techniques were developed to prepare silicon nitride ceramics using phosphate bonding techniques, leading to another patented radome material. Work in phosphate bonded ceramics resulted in a spin-off application, the preparation of building materials (such as brick) from fly ash, and another patent. Fly ash work generated considerable interest within the DOE and industry, and several technology transfer efforts were initiated. The Group has experience in carbon/carbon composites, and also coatings for carbon/carbon composites and ceramics. The coatings are prepared by phosphate bonding techniques and also by Chemical Vapor Deposition (CVD). Hafnium diboride-silicon tetraboride and hafnium-diboride-silicon carbide coatings developed at NSWCCD were the first boride-based CVD coatings reported in the literature.

The Advanced Ceramics Facility at Carderock consists of approximately $3M of equipment. This facility is unique because it represents a comprehensive capability for the complete development and characterization of ceramic materials and prototyping of ceramic components. Several of these items have capabilities which are rare in the U.S. as a whole, not just within the Navy. The facility also includes equipment for preparation of coatings and bulk ceramics by thermal spraying and by chemical vapor deposition, as well as an acoustic frequency fatigue testing machine (under development).

The facility includes equipment for synthesis, powder production, green body formation, firing, finishing, characterization and testing. Several pieces of equipment have extended capabilities beyond that which is usually offered by manufacturers, such as:

- 60,000 psi Cold Isostatic Press
- 45,000 psi/2200°C Hot Isostatic Press
- 3,000°C Hot Press
- 3,000°C Tungsten Element Furnace
- Instron with 1500°C capability

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Ceramic Science and Technology (Continued from page 3)

X-Ray Diffractometer with 2,500° hot stage
Hot Walled CVD Reactor

The capabilities of the Advanced Ceramics Facility, combined with equipment shared with other groups at Carderock (such as electron microscopes and dielectric property measurements) provide a unique opportunity for the development and testing of many types of ceramic materials. Due to the specialized equipment and experience, the facility is particularly suited for the development of ultra-high temperature materials for missiles, spacecraft, and weapon systems. The Group is also a leader in the development of hypersonic radome materials, and this knowledge can be utilized in the development of high temperature (or armored) RAM and RAS.

The Ceramic Science Group has published papers in the areas of superconductors, mullite whisker and felt, celsian ceramics, phosphate bonded silicon nitride ceramics and fly ash. This group's many patents are listed (below or on the next page).

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Ceramics and Related Patents

PATENT NO.	PATENT TITLE	INVENTORS
6,116,328	Fabrication of Tile Reinforced Composite Armor Casting	Subhash Karmarkar, Amarnath Divecha William Bruchey, Gerald Bulmash, James Kerr, William Ferrando
6,069,101	Boron Carbide/Silicon Carbide Ceramics	Inna Talmy, James Zaykoski
5,994,610	Method of Suppressing Thermite Reactions in Plasma Arc Waste Destruction System	Inna Talmy, James Zaykoski, Curtis Martin, Jon Cofield
5,965,199	Corrosion Resistant Coating Prepared by the Thermal Decomposition of Lithium Permanganate	William Ferrando
5,936,025	Ceramic Polymer Composite Dielectric Material	John Lee, Gilbert Lee, Bruce Hartmann, Harold Wendt, John Richardson
5,922,435	Ceramic Polymer Composite Dielectric Material	John Lee, Gilbert Lee, Bruce Hartmann, Harold Wendt, John Richardson
5,894,066	Boron Carbide/Silicon Carbide Ceramics	Inna Talmy, James Zaykoski
5,840,367	Process for Preparing a Two Phase HfB_2 SiB_4 Material	Eric Wuchina
5,759,620	Formation of Composite Materials by the Inward Diffusion and Precipitation of the Matrix Phase	Roger Wilson, Joseph Augl
5,695,725	Method of Preparing Monoclinic $BaO\text{-}Al_2O_3\text{-}2SiO_2$	Inna Talmy, Deborah Haught,
5,691,258	Two Phase HfB_2 SiB_4 Material	Eric Wuchina
5,642,868	Ceramic Material	Inna Talmy, Deborah Haught
5,641,440	Sintering Aids for Producing $BaO\text{-}Al_2O_3\text{-}2SiO_2$ and $SrO\text{-}Al_2O_3\text{-}2SiO_2$ Ceramic Materials	Inna Talmy, James Zaykoski

Ceramics and Related Patents

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Patent No.	Patent Title	Inventors
5,604,165	CrB_2-NbB_2/SiC Ceramic Composite Materials	Inna Talmy, Eric Wuchina, James Zaykoski, Mark Opeka
5,578,534	Method of Producing Si_3N_4Reinforced Monoclinic BaO-Al_2O_3-$2SiO_2$ and SrO-Al_2O_3-$2SiO_2$ Ceramic Composites	Inna Talmy, James Zaykoski
5,573,986	Electromagnetic Window	Inna Talmy, Curtis Martin, Deborah Haught, Anh Le
5,571,759	CrB_2-NbB_2 Ceramics Materials Zaykoski, Mark Opeka	Inna Talmy, Eric Wuchina, James
5,538,925	SL_3N_4 Reinforced Monoclinic BaO-Al_2O_3-$2SiO_2$ and SrO-Al_2O_3-$2SiO_2$ Ceramic Composites	Inna Talmy, James Zaykoski
5,521,132	Ash Based Ceramic Material	Inna Talmy, Deborah Haught, Curtis Martin
5,509,459	Pressure Cast Alumina Tile Reinforced Aluminum Alloy Armor and Process for Producing the Same	Amarnath Divecha, Subhash Karmarkar, Scott Hoover, James Kerr, William Ferrando
5,298,106	Method of Doping Single Crystal Diamond for Electronic Devices	Lawrence Kabacoff, John Barkyoumb
5,205,996	Silver Lined Ceramic Vessel	William Ferrando, Amarnath Divecha, James Kerr
5,176,788	Method of Joining Diamond Structures	Lawrence Kabcoff, John Barkyoumb
5,164,361	Method to Produce Ceramic Superconducting Filaments Bonded to Metal	Louis Aprigliano, Richard Stockhausen
5,147,731	Stabilized Zirconia Cocraly High Temperature Coating	Charles Gilmore, Earl Skelton, Louis Aprigliano, Syed Qadri
5,120,575	Silver Lined Ceramic Vessel and Method of Preparation	William Ferrando, Amarnath Divecha, James Kerr
5,091,362	Method for Producing Silver Coated Superconducting Ceramic Powder	Willam Ferrando
5,082,826	Silver Coated Superconducting Ceramic Powder	William Ferrando
5,080,752	Consolidation of Diamond Packed Powders Barkyoumb	Lawrence Kabacoff, John
5,047,387	Method for the Selecting Superconducting Powders	Inna Talmy, Deborah Haught
5,041,400	Low Temperature Synthesis of High Purity Monoclinic Celsian	
4,994,419	Low Temperature Synthesis of High Purity Monoclinic Celsian Using Topaz	Inna Talmy, Deborah Haught
4,988,673	Method for Producing Silver Coated Superconducting Ceramic Powder	William Ferrando
4,983,571	Method of Producing $YbA_2Cu_30_6$+X Superconductors with High Transition Temperatures	Srinvassa Rao, Om Arora, Louis Aprigiliano
4,948,766	Rigid Mullite Whiskers and Method of Preparation	Inna Talmy, Deborah Haught
4,911,902	Mullite Whisker Preparation	Inna Talmy, Deborah Haught
4,910,172	Preparation of Mullite Whiskers from AlF_3 SiO_2 and AlF_3O_3 Powders	Inna Talmy, Deborah Haught

Selected Recent Patents with Commercial Potential and Available for Licensing

Patent No.	Title	Inventors
5,486,811	Fire Detection and Extinguishment System	John Wehrle, Ernest Dahl, James Lugar
5,521,132	Ash-Based Ceramic Materials	Inna Talmy, Deborah Haught Curtis Martin
5,553,871	Fluid Tight Door Gasket	Marlin Rowe, Francis McMullin
5,987,397	Neural Network System for Estimation of Helicopter Gross Weight and Center of Gravity Location	Kelly McCool, David Haas
5,890,101	Neural Network Based Method for Estimating Helicopter Low Airspeed	Carl Schaefer, Kelly McCool, David Haas
5,751,609	Neural Network Based Method for Estimating Helicopter Low Airspeed	Carl Schaefer, Kelly McCool, David Haas
6,159,060	Protective Shrouding With Debris Diverting Inflow Vanes for Pump Jet Propulsor	John Purnell, Alan Becnel
6,059,618	Ventilated Outboard Motor Mounted Pump Jet Assembly	John Purnell, Alan Becnel
5,858,801	Patterning Antibodies on a Surface	Robert A. Brizzolara
6,138,724	Shipboard Paint Dispensing System	Rimi Rivera, James McDonnell, Drew Jackson, Stephan Verostos, Steven Stetz, David Barnes, Michael Murnane
6,129,135	Fabrication of Metal Matrix Compositions	Amarnath Divecha, Subhash Karmarkar, William May, James Kerr, William Ferrando, Scott Hoover
6,129,134	Synthesis of Metal Matrix Composite	Amarnath Divecha
5,833,782	High-Energy-Absorbing Enclosure for Internal Explosion Containment	Roger M. Crane, Paul A. Coffin
5,814,250	Method of Protecting a Structure	Philip Dudt, John Martin
5,473,718	Fiber Optic Loose Tube Buffer to Fan Out Tube Adapter System	Keith Sommer
5,468,570	Lightweight Zinc Electrode	William Ferrando
5,362,580	Lightweight Battery Electrode and Method of Making It	William Ferrando, Amarnath Divecha
5,411,697	Method for Processing Contaminated Plastic Waste	Peter McGraw, John Drake, Thomas Hane
5,389,411	Composite Structure Forming a Wear Surface	Edward Cohen
5,859,535	System for Detecting Size and Location of Defects in Material by Use of Microwave Radiation	John Liu

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Selected Recent Patents with Commercial Potential and Available for Licensing

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Patent No.	Title	Inventors
5,379,711	Retrofittable Monolithic Box Beam Composite Hull System	Eugene Fischer, Roger Crane
5,439,402	Design of an Integrated Inlet Duct for Efficient Fluid Transmission	Charles Dai, Christopher Kerr, Phuc Nguyen, Han-Ch'ing Wang
5,476,401	Compact Water Jet Propulsion System for a Marine Vehicle	Frank Peterson, Charles Dai, John McMahon
5,591,057	Hull Supported Steering and Reversing Gear for Large Waterjets	Charles Dai, John Allison
5,408,874	Location of Fluid Boundary Interfaces for Fluid Level Measurement	Charles Fleck, Sr., Charles Fleck, Jr.
5,797,965	Suppression of Epileptiform Activity	Mark Spano, Steven Schiff, Bruce Gluckman, William Ditto
5,760,388	Biomedical Imaging by Optical Phase Conjugation	James Swandic
5,727,381	Duct Flow Control System	Ernest Rogers
5,779,440	Flow Energizing System for Turbomachinery	John Stricker, John Purnell
5,712,424	Method and Apparatus for Measuring Diesel Engine Cylinder Pressure	Jay Reed
6,038,995	Combined Wedge Flap for Improved Ship Powering	Gabor Karafiath, Dominic Cusanelli

http://www.dt.navy.mil

Patent Licensing and Technology Transfer at Carderock

We can work for you!

Tech Transfer includes more than patent licensing and CRADAs. Our laboratories and personnel are national assets for maritime R&D. Often this fact is not understood. The specialized knowledge and facilities of the Carderock labs are available to support industry, academia, and state and federal government activities. Public law 568 (1937) noted that "experiments may be made at this establishment for private parties." Our current mission states that we are to support the Maritime Administration and the Nation's maritime industry. The extent of these lab capabilities is reported in the recently published book, "Where the Fleet Begins." This book details the work of these laboratories to transform vision into reality, and keep innovation flowing from cutting edge science and technology into the Navy's ships and submarines. The capability is also available to support you and the Nation's maritime industry.

For further information, please use our internet address: www.dt.navy.mil, or contact the Technology Transfer Office. The phone numbers and e-mail addresses are shown on this page.

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TECH *transfer* UPDATE
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